



## HIGHWAY DESIGN ORIENTATION TRAINING

This material has been developed as a training aid for engineers, technicians, and planners who expect to make frequent reference to the California Highway Design Manual, 5th edition (July 1995), and other Caltrans highway design publications or documents. An average of 10 hours will be required to complete all 12 topics. Although it is recommended that the modules be completed in sequential order, you may also select a set of questions pertaining to one specific chapter of the Manual depending on specific training needs.

### General Information - HDM Chapters 10 Thru 100

1. Match the following subjects with their correct definitions.

	A	B	C
Freeway	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Expressway	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Conventional Highway	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Definitions:

- A An arterial highway with at least partial control of access, which may or may not be divided or have grade separations at intersections.
- B A highway without control of access which may or may not be divided. Grade separations at intersections or access control may be used when justified at spot locations.
- C A divided arterial highway with full control of access and with grade separations at intersections.

2. Match the following subjects with their correct definitions.

	A	B	C
Overcrossing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Undercrossing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Separation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Definitions:

- A Where a State Highway crosses under another State Highway.
- B Where a State Highway crosses under a Local Road.
- C Where a State Highway crosses over a Local Road.

3. What is a MANDATORY design standard?

- ☐ A Any standard given in the Highway Design Manual which uses the word "shall".
- ☐ B Any standard given in the Highway Design Manual which uses the word "must".
- ☐ C Any standard given in the Highway Design Manual in bold print.
- ☐ D Both A and C.

4. Who has the authority to approve exceptions to MANDATORY design standards?
- ☐ A The District Design Division Chief.
  - ☐ B The District Director.
  - ☐ C The HQ Project Development Coordinator.
  - ☐ D The HQ Geometric Reviewer.
5. What is an ADVISORY design standard?
- ☐ A Any standard given in the Highway Design Manual which is underlined and uses the word "should".
  - ☐ B Any standard given in the Highway Design Manual which is underlined and uses the word "may".
  - ☐ C Any standard given in the Highway Design Manual which is underlined.
  - ☐ D Any standard given in the Highway Design Manual which is in bold print and uses the word "should".
6. Who has the authority to approve exceptions to ADVISORY design standards?
- ☐ A The Project Engineer in design.
  - ☐ B The District Director.
  - ☐ C The HQ Project Development Coordinator.
  - ☐ D The HQ Geometric Reviewer.
7. On projects where the project development process has started and revisions to the design standards are made, the following statement is true;
- ☐ A For all projects where the PS&E has not been finalized, the new or revised design standards shall be incorporated unless this would impose a significant delay in the project schedule or a significant increase in the project engineering or construction costs.
  - ☐ B For all projects where the PS&E has been submitted to HQ Office Engineer for advertising or the project is under construction, the new or revised standards will be incorporated only if they are identified in the Change Transmittal as requiring special implementation.
  - ☐ C For locally-sponsored projects, the Oversight Engineer shall inform the funding sponsor within 15 working days of the effective date of any changes in mandatory or advisory design standards.
  - ☐ D All of the above!
8. Which of the following statements about design speeds is NOT true?
- ☐ A When choosing a design speed for a facility, a speed equal to or greater than the anticipated posted speed should be considered.
  - ☐ B Design speed is defined as: "a speed selected to establish specific minimum geometric design elements for a particular section of highway".
  - ☐ C Terrain, economic and environmental factors, type and volume of traffic, functional classification of the highway and whether the area is urban or rural should all be factors in determining the design speed.
  - ☐ D The design speed is always equal to the posted speed.

9. What range of design speeds is appropriate for a conventional highway in downtown Sacramento?
- ☐ A 50 - 70 km/h.
  - ☐ B 60 - 100 km/h.
  - ☐ C 90 - 110 km/h
  - ☐ D None of the above.
10. What design period should be used for geometric design?
- ☐ A Geometric design should be based on traffic estimated for the period 20 years after the completion of construction.
  - ☐ B Geometric design should be based on traffic estimated for the period 20 years after the completion of construction for NEW facilities and current ADT for RRR (Resurfacing, Restoration and Rehabilitation), safety and operational improvement projects.
  - ☐ C Geometric design should be based on traffic estimated for the period 20 years after the completion of construction for NEW facilities and 15 years after construction for RRR (Resurfacing, Restoration and Rehabilitation), safety and operational improvement projects.
  - ☐ D Geometric design should be based on traffic estimated for the period 30 years after the completion of construction for NEW facilities and current ADT for RRR (Resurfacing, Restoration and Rehabilitation), safety and operational improvement projects.
11. When is formal approval of exceptions to design standards by the FHWA required?
- ☐ A Never. FHWA has delegated all approvals of design standards to Caltrans.
  - ☐ B Always. Because Caltrans receives Federal funding, FHWA approval of design standards is always required.
  - ☐ C FHWA approval of design standards is only required for urban areas.
  - ☐ D FHWA approval of design standards is required for Interstate Completion projects or new or reconstruction projects on the Interstate System costing more than \$1 million or where there is a change in access control.
12. What types of projects require a safety review during the PLANNING stage?
- ☐ A All projects costing more than \$1 million.
  - ☐ B All projects receiving Federal funding.
  - ☐ C All projects.
  - ☐ D Safety reviews are only required during design.
13. What types of projects require a safety review during the DESIGN stage?
- ☐ A All projects costing \$300,000 or more.
  - ☐ B All projects which require a Traffic Control Plan.
  - ☐ C All projects.
  - ☐ D All projects costing \$300,000 or more OR which require a Traffic Control Plan.

**Geometric Design Standards - HDM Chapter 200**

1. What length of crest vertical curve is required to provide Stopping Sight Distance (SSD) for a facility with a design speed of 100 km/h where the uphill grade is 6% and the downhill grade is 4% ?  
  - ☐ A L = 178 m.
  - ☐ B L = 200m.
  - ☐ C L = 1248 m.
  - ☐ D L = 891 m.
  
2. A sag vertical curve is to be designed to fit a -2% and a +3% grade on a two-lane road with 60 km/h design speed. What minimum length of vertical curve should be used?  
  - ☐ A L = 86 m
  - ☐ B L = 120 m
  - ☐ C L = 90 m
  - ☐ D L = 240 m
  
3. What minimum stopping sight distance shall be provided on a 550 m centerline curve to the right, half way to the bottom of a sustained 10 km, 4% downgrade? The highway is 4 lanes, undivided, with a 100 km/h design speed.  
  - ☐ A L = 190 m
  - ☐ B L = 220 m
  - ☐ C L = 264 m
  - ☐ D L = 228 m
  
4. A freeway off-ramp nose is located near the end of a crest vertical curve. What is the minimum sight distance you should provide to the ramp at the nose if the design speed of the freeway is 110 km/h?  
  - ☐ A L = 335 m
  - ☐ B L = 220 m
  - ☐ C L = 235 m
  - ☐ D L = 320 m
  
5. Two 150 m radius reversing curves are to be laid out on a two-lane highway. Using the standard superelevation rate and transition, what is the minimum length of connecting tangent?  
  - ☐ A 240 m
  - ☐ B 90 m
  - ☐ C 120 m
  - ☐ D 180 m

6. What is the minimum length of tangent between two reversing 350 m radius curves on a proposed 4-lane frontage road, parallel to the freeway, with a design speed of 60 km/h? There is expensive commercial property located adjacent to the frontage road making it uneconomical to obtain standard superelevation run-off lengths.
- ☐ A 13 m
  - ☐ B 27 m
  - ☐ C 60 m
  - ☐ D 90 m
7. A soundwall is to be located adjacent to an existing 260 m radius single lane ramp which curves to the right. How far from the edge of traveled way must the wall be placed to provide horizontal sight distance equivalent to the ramp design speed?
- ☐ A 3.6 m
  - ☐ B 8.14 m
  - ☐ C 1.7 m
  - ☐ D 6.34 m
8. What is the minimum longitudinal grade to be used on a 12 m roadbed on a rural highway in the San Joaquin Valley with a standard right-of-way width? The average height of fill is 3 m.
- ☐ A 0.5%
  - ☐ B 0.0%
  - ☐ C 0.3%
  - ☐ D 0.6%
9. A loop on-ramp in Santa Clara County is being designed with a descending grade. What is the maximum grade that should be considered?
- ☐ A -9 %
  - ☐ B -8 %
  - ☐ C -10 %
  - ☐ D -6 %
10. What minimum length tapers would you provide when a lane is dropped on a freeway in a highly developed metropolitan area with a design year ADT of 176,000? The design speed is 110 km/h.
- ☐ A 264 m
  - ☐ B 176 m
  - ☐ C 242 m
  - ☐ D 220 m
11. At what design speeds would you avoid using curbs?
- ☐ A 75 km/h and under
  - ☐ B 55 km/h and under
  - ☐ C 75 km/h and over
  - ☐ D 55 km/h and over

12. You are designing the grade line of a freeway overcrossing structure. The six-lane freeway traffic will have to be carried through bridge falsework with a minimum traffic opening of 14.7 m in each direction. At the minimum clearance point you have 7.0 m elevation difference between overcrossing bridge deck and the freeway pavement below. Using the minimum falsework depth and vertical clearance, determine how much space is available for bridge deck thickness.
- ☐ A 1.4 m
  - ☐ B 2.4 m
  - ☐ C 4.6 m
  - ☐ D 990 mm
13. On a 4-lane Interstate freeway bridge with a safety shape barrier to the left of traffic, what horizontal offset should be used?
- ☐ A 1.2 m
  - ☐ B 3.0 m
  - ☐ C 1.5 m
  - ☐ D 2.4 m
14. Where sidewalks traverse driveways, what is the maximum cross fall across the path?
- ☐ A 0.5 %
  - ☐ B 1.0 %
  - ☐ C 1.5 %
  - ☐ D 2.0 %
15. What would you install at the end of a bridge railing exposed to approach traffic?
- ☐ A Sand barrels
  - ☐ B GREAT barrier (energy attenuater)
  - ☐ C Approach railings
  - ☐ D Barrier curbs

**Geometric Cross Section - HDM Chapter 300**

1. A 2.5 km long, 6.6 m wide, 2-lane State Highway in rural rolling terrain is to be realigned. Design year volume is 1500; the route carries 10% trucks; and this segment is shown in the county general plan as a bike route. What shoulder width is required?  
  - ☐ A 1.2 m
  - ☐ B 2.4 m
  - ☐ C 0.6 m
  - ☐ D 3.0 m
  
2. If the segment in question 1 only needs to be rehabilitated, what shoulder width is required? Assume that current ADT is 1500.  
  - ☐ A 1.2 m
  - ☐ B 2.4 m
  - ☐ C 0.6 m
  - ☐ D 3.0 m
  
3. A pedestrian overcrossing structure is to be located on an urban freeway between two diamond interchanges with 1.5 km spacing. One interchange has an undercrossing structure, and the other has an overcrossing with 5.1 m of vertical clearance. What vertical clearance is required for the pedestrian overcrossing?  
  - ☐ A 4.9 m
  - ☐ B 4.6 m
  - ☐ C 5.6 m
  - ☐ D 5.1 m
  
4. Determine the overall minimum R/W width for a 6-lane rural freeway with a frontage road on one side, and flat terrain where normal slopes "catch" less than 5.5 m from the edge of shoulder.  
  - ☐ A 53.4 m
  - ☐ B 63.2 m
  - ☐ C 75.7 m
  - ☐ D 87.2 m
  
5. On a 6-lane Interstate freeway, what is the maximum diameter overcrossing structure column that is allowable in the center of an existing 6.6 m median?  
  - ☐ A 0.6 m
  - ☐ B 1.8 m
  - ☐ C 3.6 m
  - ☐ D 5.4 m

6. A 6 km long section of an 8-lane Interstate freeway is proposed for a 100 mm AC overlay. There is an overcrossing that has an existing minimum vertical clearance over the traveled way and shoulders of 4.95 m. Upon completion of the rehabilitation project, what should be the minimum vertical clearance under this overcrossing? Will a digout of the existing pavement be required at this structure?
- ☐ A 4.6 m
  - ☐ B 4.85 m
  - ☐ C 4.9 m
  - ☐ D 5.1 m
7. A 4-lane undivided highway is being designed to replace a congested 2-lane road providing access to a recreational area in the mountains where large excavation quantities are anticipated. What are the minimum median width and outside shoulder width you would call for in your design?
- ☐ A 3.6 m & 1.5 m
  - ☐ B 3.6 m & 2.4 m
  - ☐ C 6.6 m & 1.5 m
  - ☐ D 7.2 m & 2.4 m
8. A proposed exit ramp has a design year traffic projection of 1200 vehicles per hour. Only light grading will be required for ramp construction. R/W is inexpensive. How far from the left edge of ramp traveled way would you locate the R/W line (near the exit nose)?
- ☐ A 16.5 m
  - ☐ B 18.1 m
  - ☐ C 18.9 m
  - ☐ D 20.1 m
9. What is the minimum lateral clearance from the edge of traveled way to a noise barrier?
- ☐ A The same as the standard shoulder width
  - ☐ B 4.6 m
  - ☐ C 1.2 m
  - ☐ D None of the above.
10. A local agency wants to widen a freeway overcrossing at a local interchange from 4-lanes to 6-lanes. What would be the minimum width of through lanes and outside shoulders? Design speed is 55 km/h.
- ☐ A 3.6 m & 2.4 m
  - ☐ B 3.6 m & 1.2 m
  - ☐ C 3.3 m & 1.2 m
  - ☐ D AASHTO standards



11. On this same overcrossing, the locals would like to construct a raised median to place their city's "welcome" sign on the structure. What would be the minimum inside shoulder required between the through lanes and the face of curb?
- ☐ A 0.6 m
  - ☐ B 2.4 m
  - ☐ C No shoulder required
  - ☐ D AASHTO standards
12. A single-lane HOV drop ramp widens to multilane past the exit nose. Concrete barriers must be installed along the outside edge of shoulders. What would be the required minimum width of those shoulders?
- ☐ A 0.6 m
  - ☐ B 1.2 m
  - ☐ C 2.4 m
  - ☐ D 3.0 m

**Intersections At Grade - HDM Chapter 400**

1. What is the minimum angle for an intersection?
  - ☐ A 30 degrees (skewed 60 degrees from a right angle).
  - ☐ B 40 degrees.
  - ☐ C 60 degrees.
  - ☐ D 75 degrees.
2. What sight distance is required at the intersection of two State routes, if the design speed of both routes is 80 km/hr?
  - ☐ A 130 m.
  - ☐ B 170 m.
  - ☐ C 230 m.
  - ☐ D 130 m if signalized, 170 m if not signalized.
3. What desirable sight distance should be provided at the signalized ramp terminal of a spread diamond interchange where the design speed of the local facility is 60 km/hr?
  - ☐ A 85 m.
  - ☐ B 90 m.
  - ☐ C 130 m.
  - ☐ D 175 m.
4. What storage length should be provided for a peak traffic volume of 120 vehicles per hour for a left turn lane at an unsignalized intersection?
  - ☐ A 15 m.
  - ☐ B 30 m.
  - ☐ C 60 m.
  - ☐ D 120 m.
5. At a "Tee" intersection, the design speed is 100 km/hr and the width of the left turn lane is 3.6 m. What minimum transition length can be used for the channelization design?
  - ☐ A 50 m.
  - ☐ B 100 m
  - ☐ C 150 m.
  - ☐ D 240 m.
6. On a 2-lane highway, the operating speed is 100 km/hr and right of way in the area is inexpensive. What length of median deceleration lane (excluding storage) is required for left turns?
  - ☐ A 132 m.
  - ☐ B 150 m.
  - ☐ C 169 m.
  - ☐ D 240 m.

7. An undivided rural highway consists of 3.6 m lanes and 2.4 m shoulders. What additional pavement width is required to add a right turn lane?
- ☐ A 2.4 m.
  - ☐ B 3.0 m.
  - ☐ C 3.3 m.
  - ☐ D 3.6 m.
8. What turning template should be used on an interchange project on an Interstate route?
- ☐ A STAA truck template.
  - ☐ B California truck template.
  - ☐ C It depends on whether the project involves the construction of a new interchange or the rehabilitation of an existing interchange.
  - ☐ D It depends on the truck volumes using the interchange.
9. What is the best way to delineate a traffic island on a rural highway?
- ☐ A Raised paved areas outlined by curbs.
  - ☐ B Flush paved areas outlined by pavement markings.
  - ☐ C Unpaved areas.
  - ☐ D Traffic islands are generally not effective on high speed rural highways.
10. A 3-phase signal is proposed at a ramp intersection with a one-way through traffic volume of 1400 vehicles per hour (vph) on the 4-lane cross street. The single left turn lane to the on-ramp carries 275 vph. Left turns from the off-ramp to the cross street are estimated to be 600 vph. How many left turn lanes should be provided on the off-ramp?
- ☐ A One lane.
  - ☐ B Only one lane is needed, unless the volume of right turns from the off-ramp is high.
  - ☐ C Two lanes.
  - ☐ D Three lanes.

**Traffic Interchanges - Chapter 500**

1. What is the minimum spacing between two local interchanges?
  - ☐ A 2.0 km.
  - ☐ B 3.0 km.
  - ☐ C 2.0 km in urban areas, and 3.0 km in rural areas.
  - ☐ D 1.5 km in urban areas, and 3.0 km in rural areas.
2. What is an appropriate radius for a loop ramp?
  - ☐ A 30 m to 60 m.
  - ☐ B 45 m to 60 m.
  - ☐ C The radius should be greater than 60 m whenever possible.
  - ☐ D Both B and C.
3. What are appropriate radii for a set of reversing curves ("R1" and "R2") on a diagonal off-ramp?
  - ☐ A R1 = 400 m and R2 = 150 m.
  - ☐ B R1 = 320 m and R2 = 120 m.
  - ☐ C R1 = 260 m and R2 = 100 m.
  - ☐ D R1 = 180 m and R2 = 50 m.
4. What minimum tangent should be provided between the exit nose of a ramp and the beginning of the first curve, if the radius of the first curve is 250 m?
  - ☐ A 48 m.
  - ☐ B 82.3 m.
  - ☐ C 130 m.
  - ☐ D 150 m.
5. What is the preferred minimum spacing between a ramp terminus and the adjacent local street intersection?
  - ☐ A 160 m.
  - ☐ B 180 m.
  - ☐ C 200 m.
  - ☐ D 220 m.
6. When is a two-lane off-ramp needed?
  - ☐ A When at least 35% of mainline traffic exits the freeway at the off-ramp.
  - ☐ B When design year volumes for the ramp exceed 1500 equivalent passenger cars per hour.
  - ☐ C When the storage length of the ramp is not adequate.
  - ☐ D All of the above.

7. When should a two-lane on-ramp be used?
- ☐ A When the design year volume exceeds 1500 vehicles per hour, and the freeway mainline is operating near capacity.
  - ☐ B When the design year volume exceeds 1500 vehicles per hour, and an auxiliary lane is extended to the next interchange.
  - ☐ C When the design year volume exceeds 1500 vehicles per hour, and a 300 m auxiliary lane is provided.
  - ☐ D Two-lane on-ramps should be discouraged.
8. If the radius of a single-lane loop ramp is 60 m, what is the total ramp pavement width?
- ☐ A 7.2 m.
  - ☐ B 8.1 m.
  - ☐ C The width of the ramp is not dependent on its radius.
  - ☐ D Both A and C.
9. An overcrossing is 12 m wide between bridge rails, and the prevailing speed on the crossroad is 80 km/h. How far from the end of the bridge rail should the left lane of an off-ramp be located?
- ☐ A 53 m.
  - ☐ B 62 m.
  - ☐ C 71 m.
  - ☐ D 80 m.
10. How many meters of stopping sight distance should be provided on the first crest vertical curve beyond an exit nose?
- ☐ A 130 m.
  - ☐ B 160 m.
  - ☐ C 190 m.
  - ☐ D 220 m.
11. What is the purpose for using a tangent to begin a loop entrance ramp?
- ☐ A To allow adequate deceleration prior to entering the curve.
  - ☐ B To improve safety for pedestrians crossing the ramp.
  - ☐ C To facilitate the development of superelevation.
  - ☐ D To increase the visibility of the ramp divergence.
12. What length of auxiliary lane should be provided between interchanges on an urban freeway where the design year volumes are estimated to be 500 vehicles per hour for the on-ramp and 700 vehicles per hour for the off-ramp?
- ☐ A 360 m.
  - ☐ B 400 m.
  - ☐ C 500 m.
  - ☐ D 600 m.

13. An urban on-ramp is planned to accommodate 1200 vehicles per hour and a rural on-ramp is to accommodate 100 vehicles per hour? How much longer would the urban ramp acceleration lane be?
- ☐ A 0 m.
  - ☐ B 50 m.
  - ☐ C 100 m.
  - ☐ D 180 m.
14. On exit ramps, where should freeway access control terminate?
- ☐ A Access control should extend 30 m beyond the end of the curb return in urban areas, and 100 m beyond the end of the curb return in rural areas.
  - ☐ B Access control is preferred on the opposite side of the local road from ramp terminals.
  - ☐ C Access control should extend as far as necessary to ensure that entry onto the facility does not impair operational characteristics.
  - ☐ D All of the above.
15. What type of local interchange generally accommodates the highest traffic volume?
- ☐ A Spread diamond (Type L-2).
  - ☐ B Partial cloverleaf (Type L-9).
  - ☐ C Four-quadrant cloverleaf (Type L-10).
  - ☐ D Single Point Interchange (Type L-13).
16. If a reduction in the number of through freeway lanes is warranted, where should the lane reduction generally occur?
- ☐ A At a local exit ramp where through traffic decreases.
  - ☐ B Within the first tangent segment after a local exit ramp.
  - ☐ C Within 1.5 km after a local exit ramp.
  - ☐ D At least 1 km from the nearest exit or inlet nose.
17. Two diamond interchanges consist of 250 m ramps measured from inlet nose and exit nose to the cross streets. The distance between the overcrossings is 1.2 km. What is the approximate weaving distance between the interchanges?
- ☐ A 580 m.
  - ☐ B 700 m.
  - ☐ C 820 m.
  - ☐ D 950 m.
18. What minimum distance between an exit nose on a freeway exit-ramp and the end of the ramp for a full stop at the crossroad?
- ☐ A 80 m.
  - ☐ B 160 m.
  - ☐ C 240 m.
  - ☐ D 320 m.

19. What condition must be met before an exit-ramp can be designed with a “free” right turn lane?
- ☐ A Pedestrian volumes are low.
  - ☐ B The right turn lane continues as a separate full width lane for at least 60 m prior to merging, and access control is maintained for at least 60 m past the ramp intersection.
  - ☐ C No left turn movements are allowed within 125 m of the ramp intersection.
  - ☐ D All of the above.
20. What is the maximum profile grade on a freeway-to-freeway connector?
- ☐ A 6%.
  - ☐ B 8%, with the exception of descending entrances and ascending exits where a 1% steeper grade is allowed.
  - ☐ C The same as the maximum profile grade for ramps.
  - ☐ D Both B and C.
21. A new local interchange is proposed near an existing freeway-to-freeway interchange. If the proposed weaving distance between the two interchanges is 1200 m, what minimum spacing is required?
- ☐ A 1.5 km.
  - ☐ B 3.0 km.
  - ☐ C It depends on whether the area is urban or rural.
  - ☐ D The proposal is not acceptable.
22. Which one of the following is true?
- ☐ A Conceptual approval from FHWA is required for all new interchanges.
  - ☐ B Conceptual approval from FHWA is required for all new interchanges that do not meet minimum spacing requirements.
  - ☐ C Approval from Caltrans for all new interchanges is granted with the approval of a Project Study Report.
  - ☐ D Approval from Caltrans for nonstandard interchange spacing is granted through the approval of a Project Study Report.
23. A redeveloper has requested the construction of an off-ramp into the parking lot of a shopping mall. The owner agrees to pay all costs involved. This would include the cost to upgrade the local arterials to provide return movements connecting to interchanges 2.0 km to the east and west of the proposed off-ramp. The weaving distance between the proposed off-ramp and the nearest on-ramp is 1000 m. Why is this proposal unacceptable?
- ☐ A Ramps should connect only to a public road.
  - ☐ B Interchanges should provide all traffic movements.
  - ☐ C The off-ramp does not meet minimum interchange requirements.
  - ☐ D Both A and B

**Resurfacing, Restoration, and Rehabilitation (RRR) Projects**

1. The most current design standards for Resurfacing, Restoration and Rehabilitation (RRR) projects are contained:
  - ☐ A in the Highway Design Manual (HDM).
  - ☐ B in the Geometric Design Criteria for RRR Projects - Design Information Bulletin-79 (DIB 79).
  - ☐ C in the Traffic Manual.
  - ☐ D in the Project Development Procedures Manual.
2. Design criteria for RRR projects apply to:
  - ☐ A all rehabilitation projects.
  - ☐ B most projects on two lane conventional highways costing less than \$1,000,000, including curve correction, storm damage protective betterment and operational improvement projects.
  - ☐ C permit projects on two-lane conventional highways, which meet the conditions described above in "B"
  - ☐ D Both B and C
3. A project proposes to rehabilitate a portion of Route 74 in rural San Bernardino County. Existing ADT is 2,700 vpd; 10 year ADT is 4000 vpd. Truck traffic is 6%. Posted speed is 55 mph. The existing bridge and pavement width is 7.32 m. The minimum standard shoulder width (other than at bridges) for this project is:
  - ☐ A 2.4 m
  - ☐ B 1.2 m
  - ☐ C 0.6 m
  - ☐ D 0 m
4. For the project in problem #3, the bridge shoulder width standard is:
  - ☐ A 2.4 m
  - ☐ B 1.2 m
  - ☐ C 0.6 m
  - ☐ D 0 m
5. For the project in problem #3, the minimum desirable clear recovery zone is:
  - ☐ A 0.5 m
  - ☐ B 2.4 m
  - ☐ C 6.0 m
  - ☐ D 9.0 m
6. The maximum lane cross slope on a tangent roadway for a resurfacing project is:
  - ☐ A 1-1/2%
  - ☐ B 2%
  - ☐ C 2-1/2%
  - ☐ D 3%



7. A RRR project on Route 65 in the town of Lincoln is proposed. The current ADT is 16,000. Posted and 85th percentile speeds are 35 mph. The existing cross slope of the traveled way and shoulders are 2% and 6% respectively. There is curb and gutter throughout the project. The standard for the maximum shoulder cross slope is:
- ☐ A 10%
  - ☐ B 8%
  - ☐ C 6%
  - ☐ D 5%
8. On a two lane conventional highway RRR project, superelevation:
- ☐ A generally may be left "as is" if there is not a related accident pattern. However approval of a mandatory design exception is required.
  - ☐ B is always corrected to standard.
  - ☐ C is not relevant to RRR projects.
  - ☐ D none of the above.
9. A project proposes to rehabilitate a section of I-15 east of Barstow. The vertical clearances of several existing overcrossings range from 4.5 m to 4.8 m. For these structures the standard vertical clearance is:
- ☐ A 5.1 m over all lanes and shoulders.
  - ☐ B 4.9 m over all lanes and shoulders.
  - ☐ C 4.6 m over the lanes and 4.5m over the shoulders.
  - ☐ D 4.9 m over the lanes, and 4.6m over the shoulders
10. Same project as above. The cost to obtain standard vertical clearance adds 40% to the project cost. The probability of obtaining an exception to the mandatory vertical clearance standard:
- ☐ A is high. The intent of the HA-22 program is to rehabilitate the pavement. The extra money could be used to rehab a lot of lane miles.
  - ☐ B is low. The FHWA Region Office must obtain concurrence from FHWA Headquarters in Washington D.C., who will coordinate all requests of this nature with the Military Traffic Management Command (MTMC) prior to approval.
  - ☐ C is low. Project Development Coordinators do not like approving exceptions and a 40% increase in cost is in line with the Headquarters' expectations.
  - ☐ D is high. The approval for the exception is made by the District's Design Deputy

11. Bridge widening on RRR projects may be deferred:

- ☐ A in order to reduce the cost of the project.
- ☐ B in order to eliminate a significant delay due to environmental or right of way concerns
- ☐ C because adequate resources are not available to perform the bridge design in a timely manner.
- ☐ D Both B, and C. However, a follow-up structures project must be programmed as soon as possible. See the Project Development Procedures Manual Chapter 9, Article 5.

**Structural Section - HDM Chapter 600**

1. Open Graded Asphalt Concrete (OGAC), also known as an "open graded friction course", should be considered for use on both new and rehabilitation projects but it should not be used:
  - ☐ A On projects in snow areas generally above 900 m elevation and where tracking of mud from unsurfaced side roads is common and frequent.
  - ☐ B In parking areas and intersections where dripping of oil or fuel could cause the surface to deteriorate rapidly.
  - ☐ C When a life-cycle cost comparison shows significant cost savings and/or other benefits utilizing alternative materials (i.e. - such as a chip seal in a low traffic volume area).
  - ☐ D All of the above.
2. When designing a Portland Cement Concrete Pavement (PCCP) structural section with a drainage layer, the thickness of the drainage layer that should be:
  - ☐ A 105 mm of either asphalt treated permeable base (ATPB) or cement treated permeable base (CTPB).
  - ☐ B 75 mm of ATPB.
  - ☐ C 105 mm of CTPB.
  - ☐ D Either 75 mm of ATPB or CTPB.
3. Generally, the most economical pavement design should be selected based on life-cycle costs, which include:
  - ☐ A Initial construction cost plus maintenance costs.
  - ☐ B Initial construction costs only.
  - ☐ C Initial construction costs plus anticipated future pavement rehabilitation costs.
  - ☐ D Initial construction, maintenance and anticipated future pavement rehabilitation costs.
4. A drainable base of either asphalt or cement treated permeable material should be placed beneath the asphalt cement (AC) pavement:
  - ☐ A Always.
  - ☐ B Unless an exception is justified in the structural section submittal.
  - ☐ C Only on high traffic volume routes.
  - ☐ D None of the above.
5. A life-cycle cost analysis must be done for pavement type selection on new construction projects having a Traffic Index (TI) of:
  - ☐ A Greater than or equal to 12.
  - ☐ B Always.
  - ☐ C Greater than or equal to 10
  - ☐ D Greater than 12.

6. Capital Preventive Maintenance (CAPM) projects, which are designed to extend the pavement service life for 5 years, typically include items such as:
- ☐ A Upgrading geometric features.
  - ☐ B Additional surface materials, grinding pavement surfaces and/or other related work needed to preserve the existing roadway.
  - ☐ C Improving appurtenances for safety purposes.
  - ☐ D Enhancing capacity on the route.
7. Pavement structural section designs for new construction must be approved by:
- ☐ A The Corporate Headquarters, Design and Local Programs - Office of State Pavement Design and Professional Engineer Development.
  - ☐ B The Engineering Service Center - Office of Materials Engineering and Testing Services (METS), Pavement Branch.
  - ☐ C The District Director, or their designee.
  - ☐ D The Corporate Headquarters, Maintenance Program - Office of Roadway Maintenance.
8. The phrase \_\_\_\_\_ defines the length of time, after a pavement has been opened to traffic, and the length of time that is used to project the amount of one-way truck traffic loading the pavement structural section must support.
- ☐ A Pavement service life.
  - ☐ B Analysis period.
  - ☐ C Pavement traffic period.
  - ☐ D Pavement design period.
9. R-values and soil information on the soils to be encountered on a project are provided in the Geotechnical Design Report or the Materials Report for the project. If the soils on your project are identified as potentially expansive and relocating the alignment is not practicable, you should contact:
- ☐ A The District Materials Unit for special design alternatives and construction details.
  - ☐ B The Project Manager because project costs may be increasing.
  - ☐ C The Engineering Service Center - Office of Materials Engineering and Testing Services, Pavement Branch.
  - ☐ D A and B.
10. On a new facility proposed to have concrete shoulders, if there is the possibility that within the pavement design period the shoulder will be converted into a traffic lane:
- ☐ A All of the concrete shoulders should be redesigned as asphalt shoulders.
  - ☐ B The outer shoulder width should be increased to 3.6 m (lane width) and the structural section should be equal to the adjacent traveled way with the shoulder cross slope the same as the traveled way.
  - ☐ C The outer concrete shoulder should be widened to the width of the adjacent lanes.
  - ☐ D The inner shoulders should continue to be concrete, however, the outer shoulders should be changed to asphalt.

11. Standard asphalt pavement structural sections have been adopted for:
- ☐ A Roadside rests and Park and Ride lots.
  - ☐ B Ramps.
  - ☐ C Truck Weigh Stations.
  - ☐ D A and C.
12. If your project includes bridge approach slab work, the bridge approach slabs are to be designed:
- ☐ A Completely by the Engineering Service Center-Office of Structures Design.
  - ☐ B Completely by the District Materials Unit.
  - ☐ C By a combination of functional areas.
  - ☐ D A and B.
13. Typical pavement failure modes and pavement rehabilitation strategies are described in Topic 611, however, the details and procedures for completing the project approval documents for pavement rehabilitation projects are described in:
- ☐ A Highway Design Manual Chapter 100 - Basic Design Policies
  - ☐ B The Project Development Procedures Manual (PDPM).
  - ☐ C Topic 602 - Structural Section Design Procedures
  - ☐ D All of the above.

**Highway Drainage Design - HDM Chapter 800**

1. Early during the design of a project, contact with the district Hydraulic Unit should be initiated to determine which elements of the hydraulic design will be designed or reviewed by the hydraulic unit. Which of the following would typically be under the purview of the district Hydraulic Unit?
  - ☐ A Detention / Retention Basin Design.
  - ☐ B Design and placement of Edge Drains.
  - ☐ C Groundwater modeling and control.
  - ☐ D Water quality studies.
2. Upgrading of highway drainage facilities made inadequate due to upstream development may be included in normal Caltrans project funding when:
  - ☐ A There has been a 25% or greater increase in peak flow.
  - ☐ B The facility is within a regulatory floodway.
  - ☐ C The benefit/cost ratio of performing the upgrade is equal to or greater than one.
  - ☐ D The project is identified for funding in the STIP.
3. The District shall submit preliminary plans and technical / hydraulic data to the California Division Office of FHWA when:
  - ☐ A Storm drain systems have a design discharge of more than 5.6 m<sup>3</sup>/s.
  - ☐ B Highway fills will permanently impound water to a depth of 7.6 m or more or will impound 61 500 m<sup>3</sup> or more.
  - ☐ C Unusual geotechnical features exist, such as unusually deep cuts or high fills where site geology is potentially unstable.
  - ☐ D All of the above.
4. The “time of concentration” of runoff in a watershed is defined as:
  - ☐ A The length of time for runoff to travel from the most remote point of the watershed to the point where it concentrates into rill or gully flow.
  - ☐ B The length of time for runoff to travel from the most remote point of the watershed to the point of interest.
  - ☐ C The length of time for runoff to travel from the most remote point of the watershed to the bottom of the watershed.
  - ☐ D The length of time from the beginning of any runoff producing event to the peak in the hydrograph.

5. The design flood is defined as:
- ☐ A The flood event which has a one percent chance of being exceeded in a given year (the 100-yr. event), or the greatest flood of record, whichever is greater.
  - ☐ B The flood event which has a one percent chance of being exceeded in a given year (the 100-yr. event).
  - ☐ C The peak discharge flood event that will always be generated by the design storm event.
  - ☐ D The peak discharge flood event associated with the probability of exceedance selected for the highway encroachment.
6. Above what size should all curricular culverts and equivalent size pipe arches have end treatment (either flared end section or headwall)?
- ☐ A 600 mm.
  - ☐ B 900 mm.
  - ☐ C 1500 mm.
  - ☐ D 1800 mm.
7. A culvert with a total length of 50 m is needed to cross under a highway. The highway has adequate median width to allow for intermediate cleanout access to the culvert. What is the minimum diameter that the culvert should be designed for?
- ☐ A 300 mm.
  - ☐ B 450 mm.
  - ☐ C 600 mm.
  - ☐ D 900 mm.
8. What allowable limit of water spread and associated design storm should be used to design the storm drain system in a sag location that requires pumping for a multilane conventional highway with an AADT of 20,000 and design speeds under 75 kph?
- ☐ A 10-yr. storm, water spread to 1/2 of outside lane.
  - ☐ B 25-yr. storm, water spread in shoulder or parking lane.
  - ☐ C 25-yr. storm, water spread to 1/2 of outside lane.
  - ☐ D 50-yr. storm, water spread to 1/2 of outside lane.
9. What type of asphalt concrete dike is preferred for placement directly under the face of metal beam guard railing on new construction projects?
- ☐ A 150 mm Type A.
  - ☐ B 50 mm Type C.
  - ☐ C 100 mm Type E.
  - ☐ D 100 mm Type F.
10. What is the appropriate design service life for polyethylene drainage pipe to be used as a cross culvert where the roadbed width is less than 8.4 m?
- ☐ A 25 years.
  - ☐ B 25 years or 50 years.
  - ☐ C 50 years.
  - ☐ D Design service life should match return period of design storm.

11. What type of pipe joint should be called for under the following conditions? Very fine sand backfill, pipe invert 15 m above maximum groundwater elevation, hydraulic grade line will be above the soffit during the 2-year event, no soil contamination within the project area.
- ☐ A Normal joint with filter fabric wrap.
  - ☐ B Soiltight joint.
  - ☐ C Soiltight Joint with filter fabric wrap.
  - ☐ D Watertight joint.
12. What pipe materials should be allowed as 1200 mm alternative culvert under the following conditions? pH = 5.8, minimum resistivity = 3700, Height of fill over culvert = 6.1 m, pipe will be placed under the roadbed.
- ☐ A RCP, 1.63 mm CSP, 1.63 mm CASP, PPC, NRCP
  - ☐ B RCP, 4.27 mm CSP, 1.63 mm CASP, PPC, 2.67 mm CAP
  - ☐ C RCP, PPC
  - ☐ D RCP, 1.63 mm CSP, 1.63 mm CASP, 1.52 mm CAP
13. What is the recommended permissible intermittent flow velocity for an unlined channel whose sides and bottom are composed primarily of coarse gravel?
- ☐ A 2.0 m/s
  - ☐ B 2.4 m/s
  - ☐ C Use the minimum velocity calculated to prevent sediment deposition.
  - ☐ D Velocity is not the controlling criterion. Slope of the channel should be established to conform to topography to limit excessive excavation or embankment construction.
14. Which of the following stream channel protection devices would be fit in the category of flexible armoring?
- ☐ A Bulkheads, sacked concrete & fabric filled mattresses.
  - ☐ B Gabion mattresses, vegetation & riprap.
  - ☐ C Pilings, earthen dikes & fencing.
  - ☐ D Grouted rock, concrete lining & rock groins.
15. Permanent storm water quality management facilities should be designed to perform which of the following functions?
- ☐ A Limit visual impact on the surrounding environment.
  - ☐ B Provide access for maintenance equipment and personnel.
  - ☐ C Accept low flows for treatment and provide bypass for large flows.
  - ☐ D All of the above.



16. An existing 1050 mm CSP is in need of rehabilitation and it has been determined that sliplining with a plastic pipe will remedy the situation. If a liner with a manning's "n" value of 0.012 is used, the minimum inside diameter can be as small as 840 mm without creating objectionable backwater effects. Due to deflection of the existing pipe, the largest exterior dimension that the liner can have is 1000 mm. What options are viable?

- ☐ A 900 mm HDPE solid wall pipe (SDR 26) and 900 mm PVC closed profile wall pipe.
- ☐ B 900 mm Type S HDPE pipe and 900 mm HDPE solid wall pipe (SDR 32.5)
- ☐ C 900 mm PVC Ribbed pipe and 900 mm PVC closed profile wall pipe.
- ☐ D 900 mm Type S HDPE pipe and 900 mm PVC Ribbed pipe.

**Landscape Architecture - HDM Chapter 900**

1. What HQ Program is responsible for the development of policies, programs, procedures, and standards for all aspects of the Highway Planting, Safety Roadside Rest Area, Roadside Enhancement, Scenic Highway, Transportation Art, and Blue Star Memorial Highway Program and planting in conjunction with Noise Abatement Features ?
  - ☐ A Highway Maintenance Program
  - ☐ B New Technology and Research Program
  - ☐ C Transportation Planning Program
  - ☐ D Design and Local Program (Office of State Landscape Architecture)
2. Highway planting is done for what purpose ?
  - ☐ A Aesthetic, Environmental mitigation
  - ☐ B Erosion control, Headlight glare reduction, Fire retardance
  - ☐ C Windbreak protection, Graffiti reduction on walls
  - ☐ D All of the above.
3. What are the primary design standards that shall not be subordinated to aesthetics in the placement of landscape elements.
  - ☐ A Sight distance and Safety (clear recovery zone)
  - ☐ B Maintenance and Safety
  - ☐ C Cost effectiveness and Maintainability
  - ☐ D All of the above
4. In the placement of large trees within the highway right of way, what is the setback requirement for trees which at maturity, or within 10 years, have trunks 100 mm or greater in diameter, measured 1.2 m above the ground.
  - ☐ A 9 meter
  - ☐ B 7.5 meter
  - ☐ C 10 meter
  - ☐ D 8.5 meter
5. In the design of highway planting projects, "design for safety" concepts need to be considered. Which of the following need to receive District Director exception approval prior to project approval?
  - ☐ A Provide paved maintenance vehicle pullout and access gates along local street and frontage roads, pave gore areas
  - ☐ B Locate irrigation components away from traveled way
  - ☐ C Provide automatic irrigation system
  - ☐ D Providing median planting
6. Can plants be located in front of retaining walls or sound barriers that are located within the clear recovery zone?
  - ☐ A Yes
  - ☐ B No
  - ☐ C Both A & B

7. When is vine planting permitted on bridge structures?
- ☐ A When bridge located in a high seismic activity area.
  - ☐ B When bridge is in low ADT traffic area
  - ☐ C When bridge is located in wetland area
  - ☐ D None of the above
8. In the design of Safety Roadside Rest Areas, who should be involved in the review of the geometric features in a rest area?
- ☐ A District Landscape Architect
  - ☐ B Traffic Engineer
  - ☐ C Project Development Coordinator and Geometric Reviewer of HQ Design and Local Programs
  - ☐ D Maintenance
9. What is the function of a Safety Roadside Rest Area System?
- ☐ A Facility for motorist may stop for a short period to rest and relax
  - ☐ B Required to be constructed as part of the highway infrastructure
  - ☐ C Paved parking for motorist and trucks and cars to pull off the road to sleep at night
  - ☐ D Public facility for the motorist and community to use for picnic and recreation activities.
10. What item should be considered in the selection of a roadside rest site?
- ☐ A Availability of utilities
  - ☐ B Topography, scenic value
  - ☐ C Safety
  - ☐ D All of the above
11. Who is responsible for approving site selection, concepts and design for vista points?
- ☐ A Design Coordinator
  - ☐ B Design and Local Programs Geometric Reviewer
  - ☐ C District Landscape Architect
  - ☐ D District Planning and Maintenance
12. Vista Points designed for freeways shall have what type of road connection?
- ☐ A Local county road connection
  - ☐ B Standard freeway exit and entrance ramps
  - ☐ C Single lane connections
  - ☐ D Cross road connection

## Bikeway Design - HDM Chapter 1000

1. Match the following subjects with their correct definitions.

	A	B	C
Class I Bikeway (Bike Path)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Class II Bikeway (Bike Lane)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Class III Bikeway (Bike Route)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Definitions:**

- A Provides for shared use with pedestrians or motor vehicle traffic.
- B Provides a completely separated right of way for the exclusive use of bicycles and pedestrians with crossflow minimized.
- C Provides a striped lane for one-way bike travel on a street or highway.

2. When is a Local Agency required to follow the Bikeway Planning and Design guidance and standards contained in Chapter 1000 of the Highway Design Manual?

- ☐ A Only on projects within the State R/W.
- ☐ B Only on projects using State funds.
- ☐ C Only on projects using Federal funds.
- ☐ D All projects regardless of the ownership or funding.

3. Which of the following statements is NOT true?

- ☐ A For new construction and major reconstruction bicyclist should be considered when determining the roadway width.
- ☐ B When determining pavement widths, bicycles only need to be considered on roadways with designated bikeways.
- ☐ C The outside shoulder width is required to be 1.2 m minimum whenever lanes or turn pockets are added to an existing facility.
- ☐ D The entire paved shoulder and traveled way must be paved on resurfacing projects.

4. What is the minimum width required for a two-way Class I Bikeway (bike path)?

- ☐ A 4.0 m.
- ☐ B 3.6 m.
- ☐ C 2.4 m.
- ☐ D 1.5 m.

5. When is a physical barrier required between a roadway and a bike path?

- ☐ A Whenever the path is 1.5 m or closer to the edge of traveled way.
- ☐ B Whenever the path is within the clear recovery zone of the roadway.
- ☐ C Answers A & B.
- ☐ D None of the above.

6. What is the minimum width of a Class II Bikeway (bike lane) on an urban type street with curb and gutter where parking is not allowed?
- ☐ A 1.2 m.
  - ☐ B 1.5 m.
  - ☐ C 3.3 m.
  - ☐ D None of the above.
7. Which of the following statements is TRUE?
- ☐ A Bicycles are NEVER allowed on freeways.
  - ☐ B Bicycles are only allowed on freeways by permit.
  - ☐ C Bicycles are ALWAYS allowed on freeways since they have the same rights as motor vehicles.
  - ☐ D Bicycles are permitted on freeways in some instances when approved by the Headquarters Traffic Reviewer and Coordinator.

### Ramp Meter Design

1. The southbound on-ramp at the I-215/Second Street interchange in San Bernardino ascends on a 5% grade. Truck traffic represents 8% of the total. AM and PM peak hour volumes are 700 vph and 1200 vph respectively. The ramp is to be metered. At the metering stop bar, how many lanes should be provided?  
  - ☐ A 1
  - ☐ B 2
  - ☐ C 3
  - ☐ D B or C depending on whether a HOV bypass is provided, the amount of storage available and the percent of HOV's.
2. Using the same location as problem #1, and assuming the ramp is two lanes, which of the following is true:  
  - ☐ A An auxiliary lane need not be provided
  - ☐ B A 150 m auxiliary lane should be provided.
  - ☐ C A 300 m auxiliary lane should be provided.
3. Using the same location as problem #1. The on-ramp is a diagonal with a design speed exceeding 80 km/hr. What is the proper taper for the lane drop?  
  - ☐ A 50:1
  - ☐ B 30:1
  - ☐ C 15:1
4. It is proposed to meter a two-lane on-ramp where an auxiliary is provided. At which point should the ramp be tapered to one lane?  
  - ☐ A It should remain a two-lane entrance as shown in the Highway Design Manual Figure 504.3C.
  - ☐ B The ramp should be tapered to a single lane by the 2 m point.
  - ☐ C The ramp should be tapered to a single lane by the convergence point.
5. On a two-lane metered loop on-ramp, what taper should be used?  
  - ☐ A 50:1
  - ☐ B 30:1
  - ☐ C 15:1
  - ☐ D 115:1
6. For a three-lane metered on-ramp which of the following is the best answer:  
  - ☐ A 3 lanes on a loop ramp is acceptable design.
  - ☐ B An auxiliary lane should be provided.
  - ☐ C The right and left shoulder width may be 0.6 m.
  - ☐ D B and C.

7. Installation of meters on freeway-to-freeway connectors shall:
- ☐ A Be limited to locations where standard lane and shoulder widths are provided.
  - ☐ B Never be considered.
  - ☐ C Be limited to location where "tail light" sight distance is provided.
  - ☐ D A and C.
8. "Tail light" sight distance is:
- ☐ A Measured from 1070 mm eye height to a 600 mm object height.
  - ☐ B Relevant in a curve when a driver's line of sight is restricted by a median barrier.
  - ☐ C Relevant when considering reflective properties of tail lights at night.
  - ☐ D A and B.
9. When calculating the storage length, it is recommended that the minimum vehicle storage spacing for metered ramps is:
- ☐ A 6 m
  - ☐ B 7 m
  - ☐ C 8 m
  - ☐ D 9 m
10. Where ramp volumes exceed 1500 vph;
- ☐ A A 300 m long auxiliary lane, should be provided beyond the convergence point.
  - ☐ B A 100 m long auxiliary lane should be provided beyond the convergence point.
  - ☐ C A 150 m long auxiliary lane should be provided beyond the 2 meter point.
  - ☐ D A 300 m long auxiliary lane should be provided beyond the 2 meter point.

## High Occupancy Vehicle Facility Design

1. In general, HOV “preferred” geometrics conform to the Highway Design Manual (HDM) and the “acceptable” option is an alternative to be used when?
  - ☐ A When it is clearly less expensive.
  - ☐ B Only after every effort to conform to the HDM is unsuccessful.
  - ☐ C When you are extending a facility that was built to “acceptable” geometrics.
  - ☐ D The facility has a narrow median.
2. Decision stopping sight distance should be provided to the nose of all HOV:
  - ☐ A drop ramps.
  - ☐ B flyovers
  - ☐ C freeway-to-freeway connectors
  - ☐ D all of the above
3. You are designing a two-way barrier separated HOV facility on Interstate 5 in Orange County. What would be the minimum distance between barriers, and why?
  - ☐ A 7.8 m
  - ☐ B 6.3 m
  - ☐ C 6.0 m
  - ☐ D 4.5 m
4. The project described above has limited right-of-way, and the cost of purchasing more is prohibitive. Instead you propose an elevated HOV facility. What would be the minimum distance between barriers, and why?
  - ☐ A 7.8 m
  - ☐ B 6.3 m
  - ☐ C 6.0 m
  - ☐ D 4.5 m
5. What is the preferred width for an HOV drop ramp?
  - ☐ A 8.1 m
  - ☐ B 7.2 m
  - ☐ C 6.3 m
  - ☐ D 5.7 m
6. An existing 8-lane freeway has a 13.8 m median, and most of the corridor features retaining and/or soundwalls at the outside edge of shoulder. You are designing a buffer separated HOV facility in the median. What would you propose for the width of the buffer?
  - ☐ A 0.3 m
  - ☐ B 0.6 m
  - ☐ C 0.9 m
  - ☐ D 1.2 m



7. An existing 4-lane freeway has a 9 m median. A project is proposed to widen the freeway in order to provide a contiguous HOV lane, to be used during peak hours only. Truck volume is 5%. The freeway cross section typically features retaining and/or soundwalls at the outside edge of shoulder. What would you propose for the width of the median shoulder?
- ☐ A 0.3 m
  - ☐ B 0.6 m
  - ☐ C 1.2 m
  - ☐ D 2.4 m
8. What taper would you use to transition a median barrier to the width of a bridge column?
- ☐ A 10 : 1
  - ☐ B 20 : 1
  - ☐ C 50 : 1
  - ☐ D 115 : 1
9. What is the preferred way to provide an area for CHP enforcement?
- ☐ A Paved directional enforcement areas in the median spaced 3 km to 5 km apart.
  - ☐ B Paved bi-directional enforcement areas in the median spaced 3 km to 5 km apart.
  - ☐ C Continuous paved median 4.2 m or wider in both directions.
  - ☐ D All of the above are equally preferred.